

Late Intestinal Obstruction in Patients Surviving Neonatal Meconium Ileus

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■ *Two of 15 children who survived neonatal meconium ileus had "meconium ileus equivalent." They were treated with hydration, pancreatic enzyme therapy and antibiotics. One of these children died from pulmonary disease at the time of the bowel obstruction.*

The survival rate of infants with meconium ileus is steadily improving because of prompt operative intervention, better preoperative and postoperative care and long-term treatment with enzyme supplements and antibiotics. Late intestinal obstruction due to adhesive bands, volvulus, intussusception or "meconium ileus equivalent" may occur in children previously treated for meconium ileus of infancy.

The omission of pancreatic enzyme supplementation and the occurrence of respiratory infections are frequently associated with "meconium ileus equivalent."

In this series of patients four of the infants treated surgically for neonatal meconium ileus died in the early postoperative period.

MECONIUM ILEUS occurs in 5 to 15 per cent of infants with cystic fibrosis.^{4,5,15,20} It has been reported as being the cause of intestinal obstruction in up to 20 per cent of the cases in several large series of patients with cystic fibrosis treated for intestinal obstruction.^{4,14,17} Since the successful surgical treatment of meconium ileus reported by Hiatt and Wilson in 1948,¹⁰ more and more infants with this complication of cystic fibrosis are surviving the neonatal period.

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Submitted April 5, 1965.

Clinical Material

A study was made of the early mortality and incidence of late intestinal obstruction in 19 cases of meconium ileus which occurred in a group of 250 children with cystic fibrosis admitted to the University of California Medical Center, San Francisco, between 1942 and 1964.

Four patients with meconium ileus were treated successfully without operation; 14 were operated upon. One patient died before operation was possible. Five infants were operated upon in other hospitals. Three of the patients required reopera-

TABLE 1.—*Data on Infants with Meconium Ileus and Cystic Fibrosis, University of California Medical Center, San Francisco, 1942 to 1964*

Case No.	Sex	Treatment	Result
1	F	Hydration and enemas.	Intestinal obstruction due to inspissated fecal matter at 16 months of age. Well when last seen at 3 years of age.
2	M	Detorsion of midgut volvulus at 3 days of age.	Died at 6 years of age from respiratory failure.
3	M	None. (Passed "plug" spontaneously on fifth day of life.)	Well at 8 years of age.
4	F	Detorsion of midgut volvulus at 4 days of age.	Well at 15 years of age.
5	F	Hydration and enemas.	"Dilatation of the esophagus" demonstrated radiographically when last seen at 4 months of age.
6	F	Celiotomy and intravenous hyaluronidase at 2 days of age.	2 later episodes of intestinal obstruction at 5 and 12 years of age. Died during second episode from pulmonary insufficiency.
7	M	Hydration. Spontaneous evacuation of stool.	Well at 4 years of age.
8	F	Detorsion of midgut volvulus and irrigation of distal bowel at 2 days of age.	Died from pulmonary insufficiency at 8 years of age.
9	F	Celiotomy at 2 days of age. Irrigation of distal bowel with pancreatic enzyme solution.	Died from pneumonia and accompanying ileus at 2 months of age.
10	F	Operation (type unknown) performed at 2 days of age.	Reoperation for persistent obstruction on fifth day of life. Well at 14 months of age.
11	F	Ileostomy on first day of life.	Ileostomy closed after one week. Well at 3 years of age.
12	M	Enterotomy and detorsion of volvulus.	Reoperation 46 days later for persistent incomplete intestinal obstruction. Died one day later from the effects of long-standing malnutrition.
13	M	Detorsion of volvulus at 2 days of age.	Reoperation 4 days later with resection of jejunum and detorsion of volvulus. Died of peritonitis on seventh day after birth.
14	F	Enterotomy and evacuation of stool second day of life.	Associated cleft palate. Died at 2½ months of age from pulmonary insufficiency.
15	M	Enterotomy on the first day of life.	Last seen at 1 year of age. (State of health not specified.)
16	F	Ileo-ileostomy at 2 days of age.	Well at 18 months of age.
17	M	Ileo-ascending colostomy on the first day of life.	Died 13 days later of pulmonary insufficiency. Examination revealed incomplete obstruction at the anastomosis.
18	M	Ileo-ileostomy at 2 days of age.	Intestinal obstruction at 18 months of age. Concomitant melena. Treated with enemas without operation. Died at 2 years of age from pulmonary insufficiency.
19	M	None.	Died in the first 24 hours of life before operation could be performed.

tion in the early postoperative period for persistent bowel obstruction.

Fifteen of the 19 infants with neonatal meconium ileus survived (Table 1). One patient (Case 19, Table 1) died less than 24 hours after birth, before operation could be performed. A second patient (Case 17) died from respiratory failure on the 13th postoperative day. One infant (Case 12) who had a second operation for chronic incomplete small-bowel obstruction, died after persistent anorexia, on the 49th day of life. Another infant (Case 13) who required reoperation for continuing obstruction died from peritonitis seven days after the original exploration.

Late Obstruction

Intestinal obstruction occurred later in three (Cases 1, 6, 18) of the 15 survivors of neonatal meconium ileus. In two cases the obstruction was due to inspissated feces (called "meconium ileus equivalent" by Pensen).¹² One of these children (Case 1) had not been operated upon in the neonatal period. The episode of intestinal obstruction followed an illness of one week, manifested by nausea, vomiting and an upper respiratory tract infection. One of the three patients (Case 6) had two episodes of obstruction after treatment of meconium ileus by celiotomy and enemas. The first episode, when she was five years old, re-

sponded to hydration and pancreatic enzyme supplements. During the second bout of obstruction, at the age of 12, the patient died from pulmonary insufficiency. On both occasions she had been receiving pancreatic granules before entering the hospital. The other child (Case 18) had only one episode of intestinal obstruction, which was demonstrated by barium enema and relieved by further enemas, suggesting the possibility of intussusception. Both patients who had "meconium ileus equivalent" (Cases 1 and 6) responded to treatment with pancreatic enzyme replacement and hydration. Another patient (Case 9) was put in hospital at the age of two months because of vomiting and abdominal distention. Abdominal roentgenograms showed gas-filled loops of small intestine, compatible with an ileus secondary to a pulmonary infection rather than mechanical intestinal obstruction. Treatment was unsuccessful and the patient died of pneumonia.

Only one of these children was receiving pancreatic enzyme supplementation at the time of the development of "meconium ileus equivalent." One (Case 18) had pneumonia, and the first patient in the series had an upper respiratory tract infection before the recurrent episode of intestinal obstruction.

Discussion

The survival rate of infants operated upon for neonatal meconium ileus has been improving steadily. In the present series the survival rate was 79 per cent. Successful treatment depends upon early diagnosis and careful supportive measures, including accurate intravenous fluid therapy and judicious surgical intervention. Pancreatic enzyme therapy, prophylactic administration of antibiotics and vigorous treatment of respiratory infections have also enhanced the survival rate.

Little has been reported on the late gastrointestinal problems of children who have had meconium ileus in infancy.¹⁵⁻²⁰ Some of these patients may have persistent steatorrhea and uncontrolled fecal losses of nutrients despite adequate medical management, and others may have "short bowel" or "blind loop" syndrome secondary to operative treatment. Still another group may have recurrent intestinal obstruction due to "meconium ileus equivalent" or other mechanical factors (intussusception, volvulus or adhesions).^{3,8,12} Other infants initially treated by ileostomy may die because of abnormal loss of fluids and electrolytes.²

TABLE 2.—*Meconium Ileus. Review of Reported Cases*

Reported By	No. Patients	No. Survivors	No. Patients Developing Late Obstruction
Hiatt and Wilson ¹⁰	8	5	No follow-up
Bodian ⁹	18(3) ^a	6	0
Gross ⁷	63(1)	22	1 ^b
Thomsen ²¹	5	2	No follow-up
Bettex ¹	14	1 ^c	5
Wangensteen ²²	5(2)	2	No follow-up
Nixon ^{15, 16}	28	6	1
Clatworthy ⁴	12	7	No follow-up
Santulli ¹⁸	37	12	1
Fox ⁸	12(1)	6	1
Herson ⁹	17	6 ^d	0
MacDonald ¹³	27	9	1
Hill ¹¹	28	17	No follow-up
Graham and Jaffe (1964)	19(5)	15 ^e	3
Totals	293	116	13

^a Figure in parentheses indicates number of patients treated without operation or who died preoperatively.

^b A later report (Shwachman,¹⁹ 1956) describes two additional patients who developed "meconium ileus equivalent."

^c Six infants lived 33 to 60 days; one was well at 9 months of age.

^d One died at 2 months of age with pulmonary complications.

^e Two additional patients failed to survive the first year of life.

In the present series, recurrent mechanical obstruction of the small bowel due to impaction with inspissated feces occurred in 2 of the 15 patients surviving neonatal meconium ileus. One of these children died at the time of the second obstruction. In this study the incidence of late intestinal obstruction in infants who survived meconium ileus of the newborn was greater than in other reported series (Table 2). This apparently high incidence of late intestinal obstruction may possibly be explained by the lack of follow-up data in some of the other reported series and the small number of patients reported here. Although Bettex¹ reported five instances of secondary intestinal obstruction in 14 patients after the successful treatment of neonatal meconium ileus, only one of the patients survived the second operation.

Five of the six children with cystic fibrosis from the University of California Medical Center who have experienced "meconium ileus equivalent" had not been receiving supplementary pancreatic enzymes at the time obstruction developed, and three had upper respiratory tract infections. The use of pancreatic enzyme supplementation is important in the prevention of "meconium ileus equivalent." The combination of upper respiratory tract infections and the discontinuation of pancreatic supplementation are contributory to "meconium ileus equivalent."

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